Quorum Corporation








*Grain Monitoring Program*
*Supplemental Study*

# *A Comparison of the Canadian and US Grain Supply Chains*

***Grain Supply Chain Study:***

***Technical Document***

***September 2014***

# Foreword

On March 18, 2011 the Government of Canada announced its response to the Rail Freight Service Review that was undertaken in 2008 to address the ongoing issues with rail freight service raised by users of the rail freight supply chain.

In December 2011 Quorum Corporation was contracted by Agriculture and Agri-Food Canada (AAFC) and Transport Canada (TC) as part of its mandate as the Grain Monitor, to undertake a supplemental program study to analyze the grain supply chain.

This document was prepared as part of the technical, analytical and research component of the study and is presented as a supplemental work item for the Grain Monitoring Program.

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# Introduction

The following provides an overview of the United States' grain supply chains including industry demographics, grain handling infrastructure and transportation and logistics networks and compares them to the Canadian grain system. We have undertaken bi-lateral consultations with stakeholders in the US and Canada to garner insight into supply chain practices to understand similarities and differences between the two systems. The mandate of the project limited the scope of this examination to a comparison of the two systems and does not include a benchmarking of system performance or an in depth comparison of the two marketing systems.

## *Overview*

While there are similarities between the US and Canadian systems the differences are significant – in terms of production volume, markets served and the competitive landscape. The volume of grains produced in the US is almost six and a half times higher than Canada at 523 million tonnes. With a population more than ten times that of Canada US grain production is heavily focused on domestic markets with only 24% of US production destined to export markets as compared to Canada which exports over 51% to world markets (see Table 1).

**Table 1: US vs. Canadian Grain Production (Major grain crops, 3 year average to 2011) (Source: United States Department of Agriculture, Canadian Grain Commission, Statistics Canada)**

| | US | Canada |
|---|---|---|
| Production (Tonnes 000's) | 523,737 | 80,239 |
| Exports (Tonnes 000's) | 124,858 | 41,089 |
| Export % | 24% | 51% |

The most striking difference between the two countries' grain industries is the significance of corn as a percentage of total US crop production. More than 61% of the US crop on average has moved to meet the demands of both the ethanol production (driven by federally legislated mandates) and the livestock industry. Although Canada has significantly less total production, the higher diversification among crop types as shown in Figure 1 would provide support for a level of longer term market stability,.

The types of crops grown in the United States as compared to Canada are greatly influenced by climate, as certain types of grain will grow better in one climate as opposed to another. Figure 2 shows the "Plant Hardiness Zones" in North America. The light and dark orange areas that are spread across the Canadian Prairies designate areas where the lowest temperatures fall in the $-30^0$ to $-40^0$F range and corresponds

closely with the area that is the most northerly area of farmable land. As one moves south through the central US states, average temperatures increase as do normal cropping patterns.

While production volume, export proportion, crop mix and climate are four of the most distinguishing factors between the two country's grain industries, there are many other characteristics of these systems including: the variability of traffic flows, the impact of government led programs and mandates, the types and uses of transportation infrastructure, the use of and destination for the commodities that are grown, and the level of market competition that exists in the US market as opposed to Canada. These issues are explored in greater detail in the following sections.

**Figure 1: Canadian Grain Production by Commodity Group** (Source: United States Department of Agriculture, Canadian Grain Commission, and Statistics Canada)

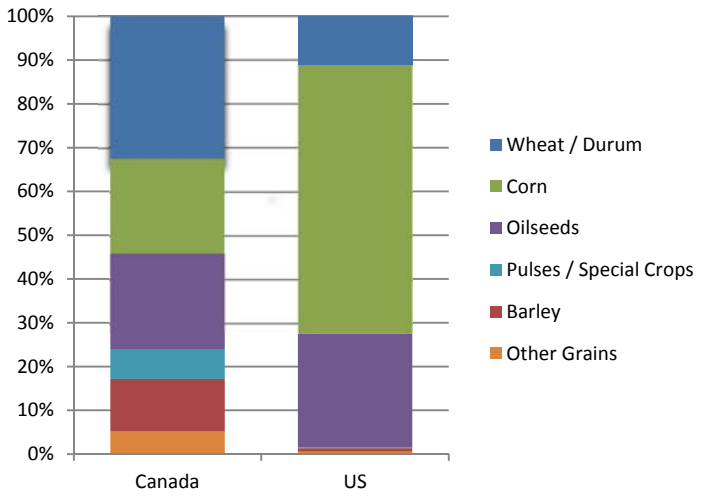
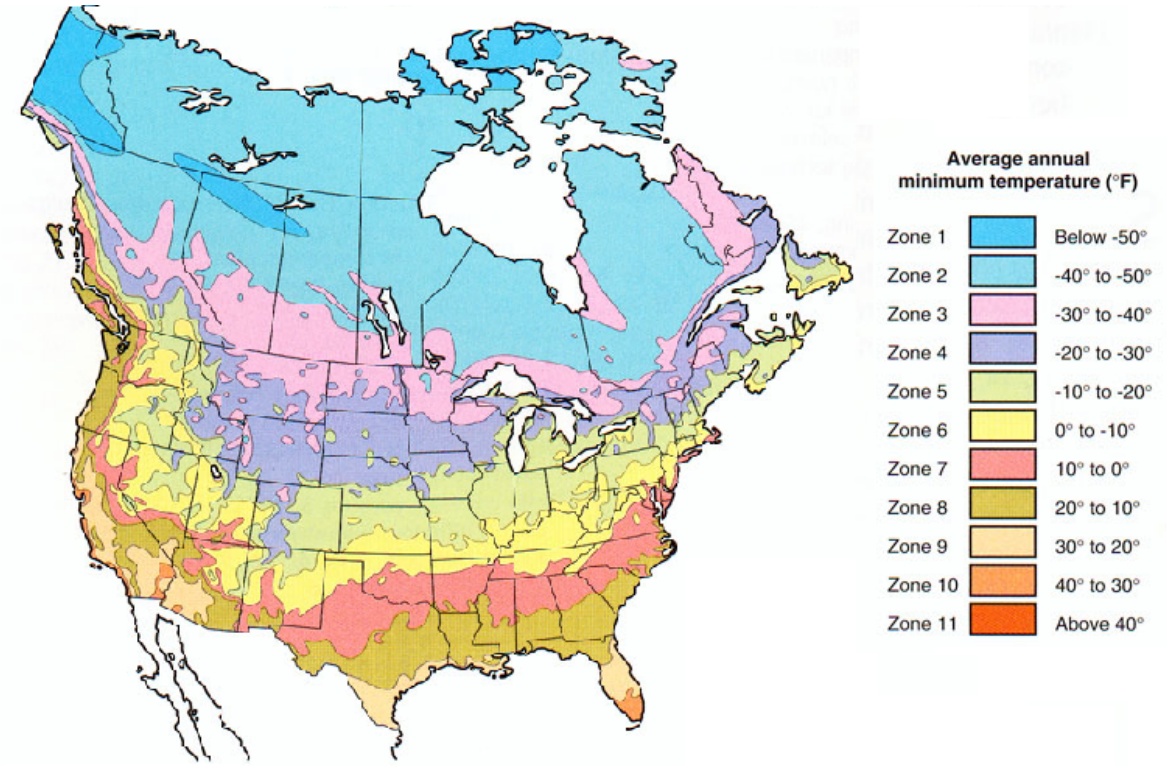



**Figure 2: North American Plant Hardness Zones** (Source: United States Department of Agriculture – Agricultural Marketing Service



# Production

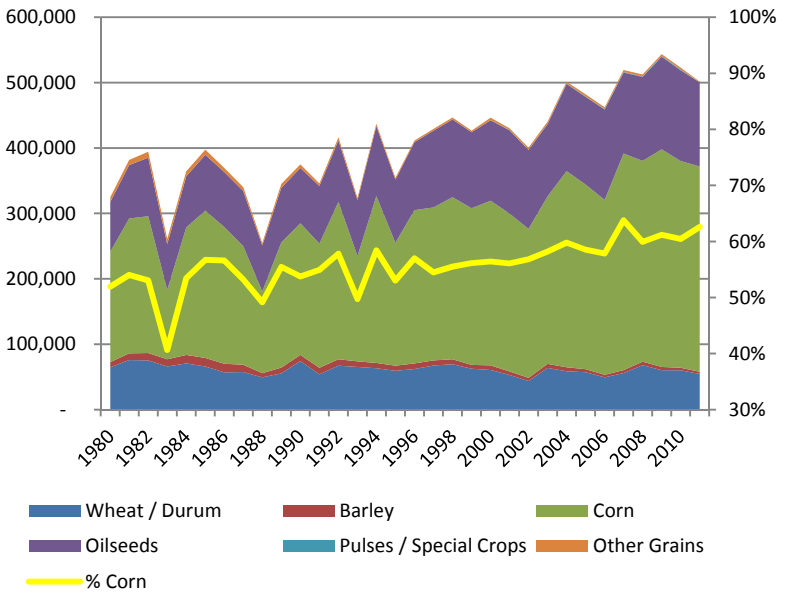
As noted in Table 1 above, the annual volume of grain produced in the US is some six and half times greater than Canada at an average of 523.7 million tonnes (MMT). Table 2 below shows that corn, based on the average of the last three years, is the US's largest crop at 321 MMT. Next is the oilseeds segment at slightly more than 136 MMT followed by wheat at 58 million tonnes. Pulses and other grains make up the remaining 8 MMT.

**Table 2: US and Canadian Grain Production (Tonnes)[1]**

| Commodity Group | Canada | % of Total Crop | United States | % of Total Crop |
|---|---|---|---|---|
| Wheat / Durum | 26,098 | 33% | 58,280 | 11% |
| Barley | 9,635 | 12% | 4,089 | 1% |
| Corn | 17,253 | 22% | 320,877 | 61% |
| Oilseeds | 17,627 | 22% | 136,469 | 26% |
| Pulses / Special Crops | 5,496 | 7% | 1,155 | 0% |
| Other Grains | 4,132 | 5% | 2,866 | 1% |
| **Grand Total** | **80,239** | | **523,737** | |

At 61% corn's share of total US crop production has risen by more than 20% since the early 1980s when it represented only 50% of US production (see Figure 3). Growth in corn production has been driven by demand for the production of ethanol in response to issues pertaining to increases in bio-fuels in transportation fuels. In the ten year period between 2001 and 2011 corn used in ethanol production increased from 16 million to more 104 million tonnes. The price of corn has increased more than three fold in the same period – from less than $2.00 a

**Figure 3: Corn as Percent of Total US Production: 1980-2010**




[1] Source: United States Department of Agriculture, Canadian Grain Commission, Statistics Canada - 3 year average 2009-2011

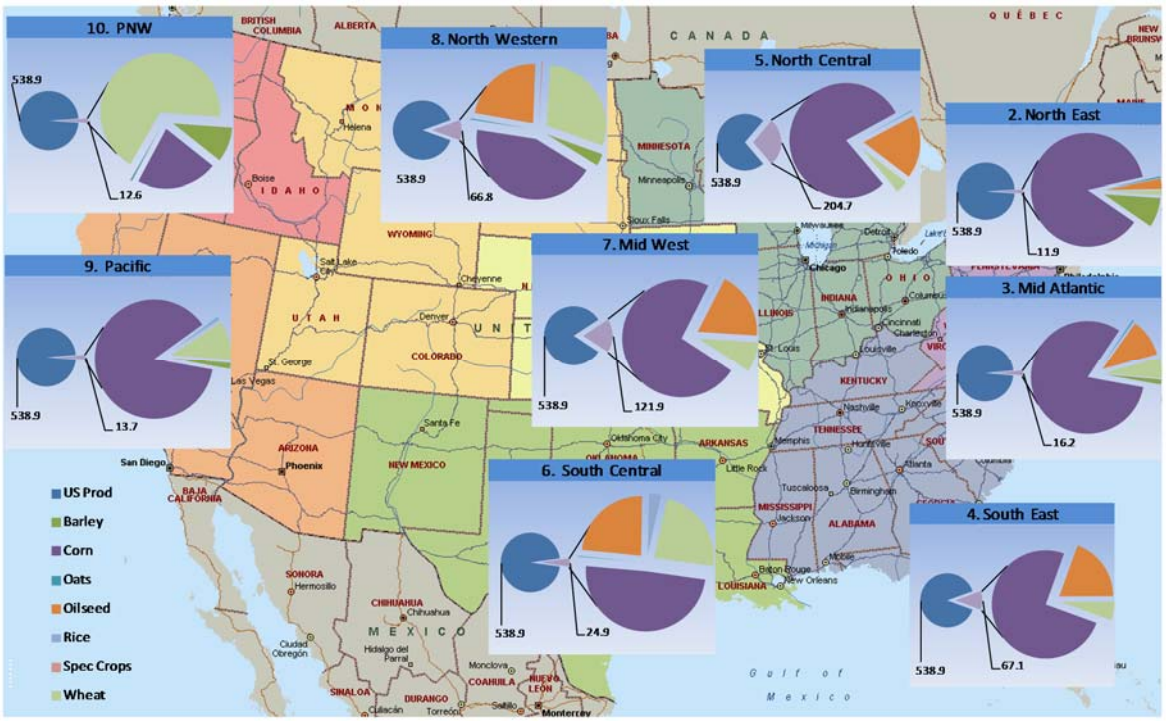
bushel in 2000 to over $6.00 in January of 2012. In the same period, production yield has increased 15% in the US – moving from 16 tonnes/ acre in 2000 to 18.4 tonnes/ acre in 2011.

US oilseeds production is comprised mostly of soybeans (over 90 MMT) with the remainder consisting of canola, peanut and cottonseed. By comparison Canadian oilseed production is dominated by canola which accounts for 70% of total production of these grains. Wheat is the next most important crop grown in the United States, about half of which is destined for export. At approximately 25 million tonnes US wheat exports are equal to total Canadian production.

## *Regional Crop Production*

The map in Figure 4 summarizes crop production statistics by major grain and USDA region.[2] [3] As we can see, with the exception of the Pacific Northwest and the Northwestern states, corn dominates production across the country. By far the largest grain production region in the US are the North Central states consisting of Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. The infamous US corn belt reaches from Illinois in the north, south to Kansas and Northern Texas in the Mid West region. The second largest crop in

**Figure 4: US Crop Production by Grain and USDA Weather Region (Source: USDA Crop Production data, 2009-2011)**




[2] The regional breakdown used for the presentation is based on the USDA weather districts (as determined by the US Environmental Protection Agency). While there are ten USDA weather regions in use, only nine produce sufficient volumes of grain to be measured

[3] Region 1 is the East Central which comprises the US north eastern states of Maine, Rhode Island, Vermont, New Hampshire and Massachusetts

these regions is soybeans. In the Northwestern and Pacific Northwest regions, wheat is the main crop, followed by corn, soybeans and barley.

Not unlike Canada, the regional dispersion of crop types is driven largely by climatic conditions and market demand that typically drive producers' seeding decisions. However, in the US, the last 10 years has seen a distinct rise in the influence of ethanol subsidies and incentives on producer production decisions driven by the US Government's desire to increase the production of ethanol in order to reduce its reliance on foreign oil imports.

The majority of US grain production moves to domestic markets with only approximately 24% of production exported. The central and eastern growing regions supply much of the domestic requirements, while the western regions sell a larger proportion of their production into the export marketplace, largely due to their proximity to port position and the attendent end markets.

## *Factors impacting Production Decisions*

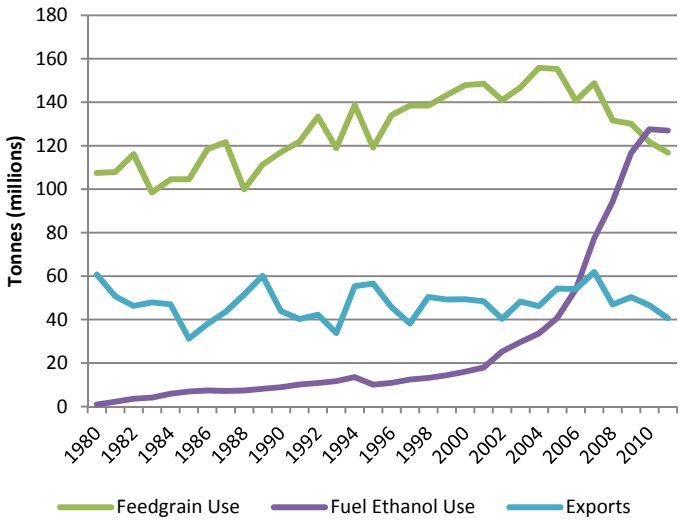
Grain production in the United States is to a much greater degree than Canada influenced by government policy. This is most evident in the US government's direct involvement in the ethanol industry and through farmer assistance programs.

### Increased Production of Bio-Fuels

The United States has long sought to reduce its dependence on foreign oil supplies. This combined with the strong political influence of environmental groups to increase the proportion of bio-fuels in fuel to promote lower vehicle emissions has led to legislative initiatives promoting and mandating the production of ethanol in the US.

With 57.5% of world production the US is the world's largest producer of ethanol.[4] This has been accomplished through a multi-pronged strategy of tax incentives, tax credits and legislated mandates

**Figure 5: Corn use in US ethanol production: 1980 - 2011 (Source: U.S. Department of Agriculture, Feed Grain Database)**




[4] F.O. Lichts. "Industry Statistics: 2010 World Fuel Ethanol Production". Renewable Fuels Association.

setting the amount of bio-fuels to be blended into transportation fuels. The result has seen a remarkable increase in the use of corn in the production of ethanol, as can be seen in Figure 5.

The Energy Policy Act of 2005 established the first set of mandated ethanol inclusion targets for gasoline. It also provided tax benefits (through load guarantees) to companies investing capital in ethanol production. This was followed by the Energy Independence and Security Act (EISA) in 2007 which set the second round of targets for bio-fuels blending requirements raising them from 9 billion gallons in 2008 to 36 billion gallons by 2022. The current goal is to see a 15% bio-fuel blend in all transportation fuels (gasoline and diesel) by 2022.

Domestic fuel and ethanol producers are protected by an import tariff of 54 cents / gallon, sufficient to ensure that a minimal amount of off shore product can be competitive in the domestic market. Further, prior to the abolishment of these credits in January of 2012, blenders of transportation fuels received a 45 cent / gallon tax credit for every gallon that was produced with ethanol content.[5] With the removal of the tax credits, the sole motivating factor for the production of ethanol remains the blending standards as set in the EISA and renewed each year through a regulatory oversight panel.

## USDA Assistance for Farmers

The United States government provides assistance to farmers through various price guarantee programs. Marketing Assistance Loans (MALs) and Loan Deficiency Payments (LDPs) were reauthorized in the 2008 Farm Bill.[6] Available upon harvest, MALs provide cash to producers when market prices are typically at their lowest.

MALs are non-recourse loans available for prescribed commodities.[7] Loan rates are specified in the law (see table 3). The MAL allows producers to delay the sale of commodities until more favourable market conditions or higher prices are available. This also facilitates orderly marketing of commodities throughout the year. The MAL can be either redeemed by repayment or by delivering the pledged collateral to the Commodity Credit Corporation (CCC) as payment upon maturity (end of the ninth month following approval of the MAL).[8] The producer can repay the loan at the rate established by the CCC for the commodity (essentially a market price which may vary by county) if that price falls below the level of the loan principal, thereby achieving a marketing loan gain.

[5] A designated small producer could gain another 10 cents/ gallon over and above this amount

[6] The 2008 Farm Bill largely continues loan programs that were in place under previous laws. It expired on 30 September 2012 when Congress passed a one year extension to 30 September 2013. Both the Senate and the House of Representatives proposed steep cuts to subsidy levels in their deliberations leading up to the expiry, but were unable to finalize new legislation. Work will continue in 2013 on new legislation by both bodies and reconciliation of legislation will be necessary prior to finalizing a new five year Farm Bill.

[7] MALs and LDPs are available for wheat, corn, grain sorghum, barley, oats, upland cotton, extra-long staple cotton, long grain rice, medium grain rice, soybeans, other oilseeds (sunflower seed, rapeseed, canola, safflower, flaxseed, mustard seed, crambe and sesame seed), dry peas, lentils, small chickpeas, large chickpeas, graded wool, non-graded wool, honey and peanuts. Dry peas, lentils and small chickpeas were added to the eligibility list for the 2002 crop. Large chickpeas were added to the eligibility list for the 2009 crop.

[8] The Commodity Credit Corporation (CCC) is a government owned corporation established to "stabilize, support, and protect farm income and prices" (CCC Charter Act of 1948).

LDPs provide income support to producers who choose not to receive MALs even though they may be eligible. They provide direct payments equivalent to the marketing loan gains that could be achieved via an MAL. The producer receives a payment when the alternative MAL repayment rate for a specific commodity is below the loan rate for that commodity. The payment is calculated as the established loan rate for the commodity, less the repayment rate (established by the CCC) multiplied by the eligible quantity. The loan rate therefore establishes a floor price for producers. The table below outlines a selection of loan rates established by the 2008 Farm Bill (equivalent metric conversions have been added).

**Table 3: Loan rates from 2008 US Farm Bill**

| Commodity | 2008 Crop Year | 2009 Crop Year | 2010-2012 Crop Years |
|---|---|---|---|
| Wheat | $2.75/bu. ($101/mt) | $2.75/bu. ($101/mt) | $2.94/bu. ($108/mt) |
| Corn | $1.95/bu. ($77/mt) | $1.95/bu. ($77/mt) | $1.95/bu. ($77/mt) |
| Barley | $1.85/bu. ($85/mt) | $1.85/bu. ($85/mt) | $1.95/bu. ($90/mt) |
| Oats | $1.33/bu. ($92/mt) | $1.33/bu. ($92/mt) | $1.39/bu. ($96/mt) |
| Soybeans | $5.00/bu. ($184/mt) | $5.00/bu. ($184/mt) | $5.00/bu. ($184/mt) |
| Other Oilseeds (canola) | $9.30/cwt. ($205/mt) | $9.30/cwt. ($205/mt) | $10.09/cwt. ($222/mt) |
| Dry Peas | $6.22/cwt. ($137/mt) | $5.40/cwt. ($119/mt) | $5.40/cwt. ($119/mt) |
| Lentils | $11.72/cwt. ($258/mt) | $11.28/cwt. ($249/mt) | $11.28/cwt. ($249/mt) |

Strong commodity prices in recent years have for the most part surpassed the loan rates. Although MALs continue to provide operating cash for producers, LDPs have been unnecessary. Indications from research done this far are that the next US Farm Bill, when passed, will include significant cuts to producer assistance programs. Table 3 shows the relative loan rates currently in effect by commodity type.

While not as robust or far reaching as the US loan assistance programs have been over the years, Canada does have certain “safety net” programs in place administered at both the Federal and Provincial levels that are designed to provide assistance during times of hardship for producers (directed primarily at periods of drastic crop failure). Canada does not have a program that provides direct assistance or support of grain prices during “low market” periods.

# Infrastructure

The significance of domestic versus export markets in the United States necessitates more grain storage capacity closer to point of sale for grain companies and dealers to buy, hold and leverage supply and price. By comparison, with its higher dependence on export movements, the Canadian industry uses more of a just-in-time approach storage and distribution strategy whereby companies look to source grain at the farm gate and match it to an export sale.

Consequently the US has sufficient storage between the farm, country network and port terminals to hold approximately 125% of annual production. (See Table 4 below). Canada has a proportionately lower ratio with total storage capability when viewed relative to licensed storage. Based on Western Canada capacity, it is estimated that the system has the capability to store slightly less than one year's crop.

Licensing standards for country elevators are different between the two countries. In the U.S. licensing is based on criteria relative to a company's authorization to administer farm assistance programs including MALs and LDPs. In Canada licensing applies only to facilities moving western Canadian (regulated) grains[9], and is tied to a company's grain trading activity and the requirement to ensure the company's liability to producers is protected. Table 4 shows the relative storage capacity in the US and Canada in 2011.

**Table 4: Comparison of U.S. and Canadian Grain Storage Capacity**

| | On Farm Storage | Off Farm (Country) Licensed Storage | Off Farm (Country) Un-licensed Storage | Port Terminal Storage | Total | *Five Yr Avg. Annual Prod.* |
|---|---|---|---|---|---|---|
| *United States- Grain Storage Capacity(1)* | | | | | | |
| Facilities | n/a | 2,583 | 6,316 | 51 | 8,950 | *523.74* |
| Storage (Tonnes, Millions) | 354.86 | 136.78 | 144.14 | 7.15 | 642.93 | |
| *Canada - Grain Storage Capacity(2)* | | | | | | |
| West | | | | | | |
| Facilities | n/a | 390 | n/a | 16 | 406 | |
| Storage (Tonnes, Millions) | 49.3 | 6.68 | n/a | 2.56 | 59.04 | |
| East | | | | | | |
| Facilities | n/a | | | 11 | 11 | |
| Storage (Tonnes, Millions) | Not known | n/a | n/a | 2.07 | 4.57 | |
| Total Canada | | | | | | |
| Facilities | n/a | 390 | Not known | 27 | 417 | *124.86* |
| Storage (Tonnes, Millions) | Not known | 6.68 | Not known | 4.63 | 63.61 | |

*1- Based on 2011 USDA/ GIPSA Data, 2- Based on CGC Data and Quorum estimates for on-farm storage*

[9] Canada does not collect information or data on grain storage and warehousing of grain in Eastern Canada with the exception of those facilities operating at a port position. Canada also does not collect information on the amount of on-farm storage. The amount stated above is based on an estimate calculated by Quorum based on the total average annual production and movement.

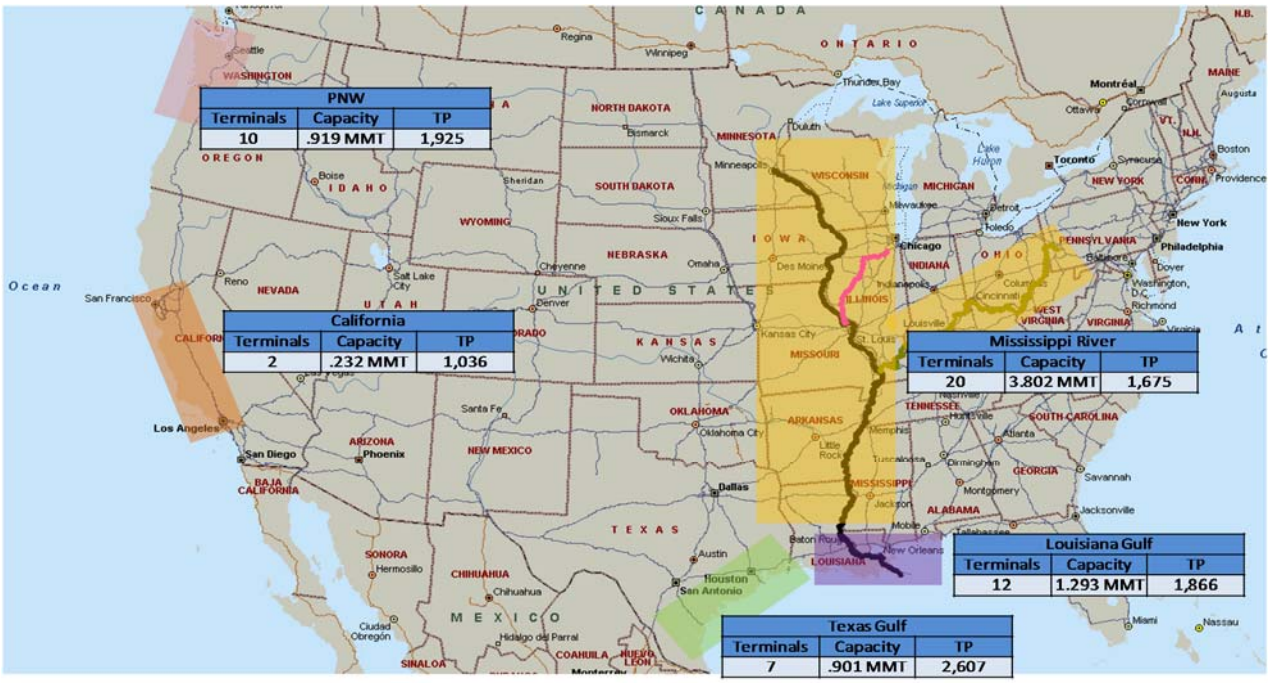
## *Port Infrastructure*

The U.S. grain industry has 51 port terminals throughout the U.S. west and gulf coast areas and the Columbia and Mississippi river systems. These facilities are grouped and displayed in Figure 6 below. In each of the regions, the number of terminals, storage capacity and the hourly throughput (in tonnes) is noted.

Not unlike Canada, most port terminal facilities serve export markets, receiving grain primarily by rail from country origins (or by barge in the case of the Louisiana Gulf facilities) for furtherance by ocean vessel.

The most direct competition with Canada's port terminal network exists between the Pacific Northwest (PNW) terminals and those on Canada's west coast at Vancouver and Prince Rupert. While capacity and throughput are similar - Vancouver and Prince Rupert have 7 facilities as compared to the PNW's 10 with each handling 15-17 MMT annually and having comparable hourly average loading rates - they differ in design and physical proximity to ocean lanes. Only three of the PNW facilities are located directly on tidewater while the other seven are located along the Columbia River. Five of the Columbia River facilities are also designed with railway "loop tracks" which significantly increases their railcar unloading capability.

**Figure 6: U.S. Port Terminals by Region (Source: US Directory of Export Elevators at Export Port Locations, USDA, GIPSA)**




The majority of grain moving through these facilities flows from US PNW and Northwestern regional shippers. It should be noted that prior to the change in the Canadian Wheat Board marketing mandate, there was little movement of Canadian grain into these facilities. Since August 1, 2012 commercial arrangements between Canadian Pacific and Union Pacific which serves the Columbia River area have provided Canadian shippers

with competitive freight rates. If these terminals choose to offer comparable pricing it is likely this routing option will become a competitive option for shippers of Canadian grain.

The Texas Gulf facilities are all rail served and handle grain traffic flowing from the South Central and Mid West Regions. These terminals represent the second largest coastal concentration of storage capacity in the U.S.[10] and collectively have the highest loading capability of any regional port grouping in North America.

The Mississippi River terminal network consists of 20 terminals that load barges for movement through the inland waterway to tidewater. The river barge system runs from Minneapolis, Chicago (starting on the Illinois River) and Pittsburg (on the Ohio River) in the north through to Baton Rouge. The 12 terminals in the Louisiana Gulf region are serviced by both barge and rail and serve the central US regions for export grains while the terminals in the California ports are smaller facilities that cater primarily to niche markets.

**Table 5: Top 10 United States port terminal operators**

| Rank | Company | Facilities | Storage Capacity (Tonnes) | Hourly throughput (Tonnes) | Market Share |
|---|---|---|---|---|---|
| 1 | Cargill | 6 | 1,103,400.0 | 2,676 | 15.4% |
| 2 | The Andersons | 4 | 984,141.0 | 1,123 | 13.8% |
| 3 | Archer Daniels Midland | 9 | 948,300.9 | 1,941 | 13.3% |
| 4 | CHS Inc | 1 | 529,628.6 | 1,200 | 7.4% |
| 5 | Louis Dreyfus Inc | 4 | 421,840.0 | 1,837 | 5.9% |
| 6 | Riverland Ag | 1 | 381,017.0 | 5,171 | 5.3% |
| 7 | Chicago & Illinois River Marketing | 1 | 285,763.0 | 816 | 4.0% |
| 8 | TEMCO LLC | 2 | 271,318.6 | 1,951 | 3.8% |
| 9 | Gavilon Grain | 1 | 244,940.0 | 2,041 | 3.4% |
| 10 | Penny Neuman Grain | 1 | 198,142.9 | 1,500 | 2.8% |

Ten companies control 75% of U.S. port terminal operations. Canada by comparison has 75% of its terminal ownership controlled by five grain companies – Viterra, Richardson, Cargill, Parish and Heimbecker and Paterson). As is the case in Canada the major equity partners that own port terminal assets in the U.S. also have significant holdings in the country elevator network. Table 5 provides a summary of U.S. terminal ownership and infrastructure.

Operationally there are few differences between the Canadian and the US port terminal networks. One exception would be the differences in age of many of the structures. The majority of Canadian port terminal

[10] While the Port of Thunder Bay has the largest concentration of storage at one port (1.15 MMT), collectively the Texas Gulf facilities which are within 250 miles of one another exceed it

facilities were initially built between 60 and 80 years ago, with only two being built within the last 25 years. In the US there have been more than 12 terminals constructed in the past 10 years. As noted above, one significant difference in the new design of a port terminal facility is the increase in the use of railway loop tracks. Loop tracks allow a full train to be unloaded without breaking apart the train, speeding the process with the associated efficiency in capacity and asset utilization. In Canada, all port terminal facilities are designed with either stub end or flow through tangent tracks that require trains to be broken apart and switched into position. This design, which dates back to the first half of the 20th century, was driven by the desire of port planners to optimize waterfront acreage at a port and in consideration of railway operational practices at the time that saw the majority of grain moved to port using manifest trains. Terminals developed today reflect the increased use of unit train configurations and seek to exploit the efficiencies that practice offers.

## *Country Elevator Infrastructure*

There are significant differences in how the country elevator systems in the U.S. and Canada operate and are regulated. Whereas Canada regulates, licenses and maintains records only for country facilities that handle western Canadian grains, the U.S. maintains extensive records of all licensed and unlicensed facilities – known as public warehouses - that receive, forward and/ or process grain, whether that is for domestic or export use. As such the availability of data on the US network is far more expansive than that available in Canada.

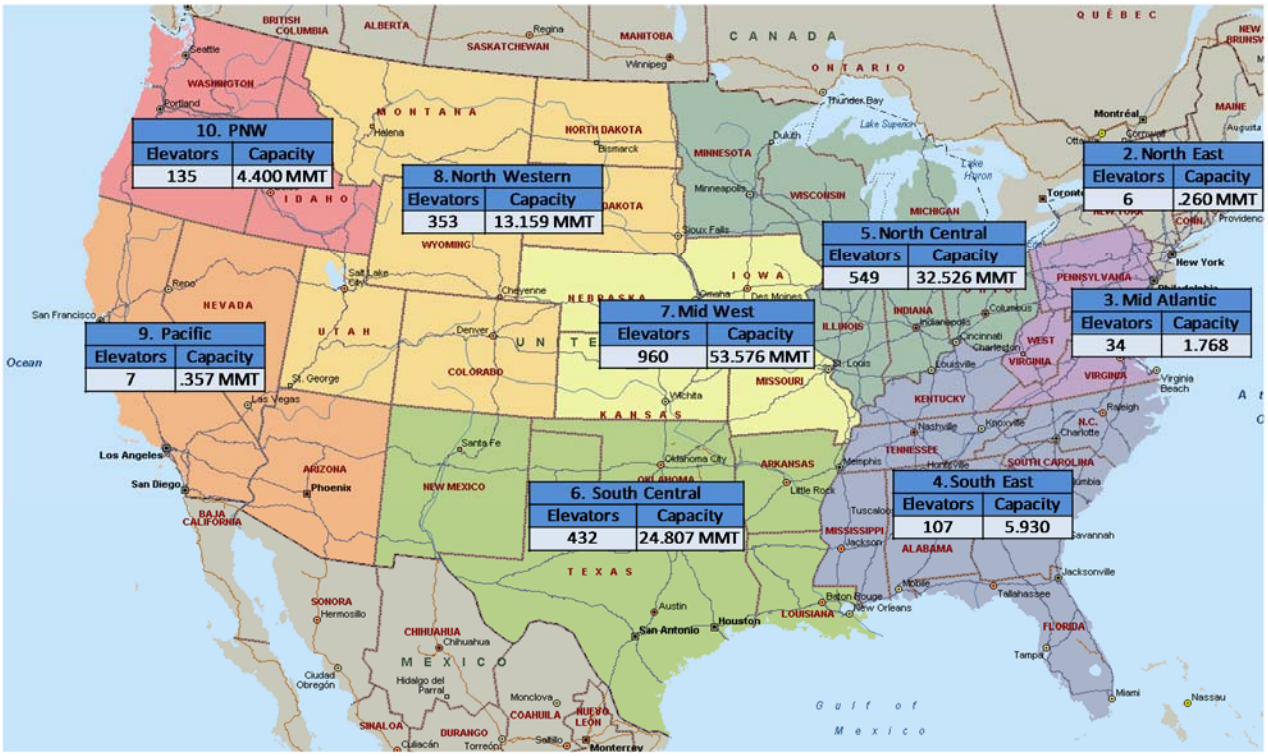



**Figure 7: U.S. Grain Country Licensed Handling and Storage Facilities and Capacity**

A facility in the US that obtains a Grain Inspection, Packers and Stockyards Administration (GIPSA) license is entitled to receive and administer grains that are sold under Marketing Assistance Loans (MALs) and Loan Deficiency Payments (LDPs) (as discussed above). In Western Canada all facilities handling grain must obtain a license from the Canadian Grain Commission, whereas facilities in Eastern Canada do not.

Figure 7 above illustrates the total number of licensed US country handling facilities and the attendant storage capacity in each region.

Licensed storage and handling facilities encompass less than half of the US country grain receiving and storage network. As such an extensive unlicensed, off farm network of facilities exists that supports both the domestic and export markets. When the country network is viewed regionally in comparison to production, the proportion of facilities and corresponding storage capacity are proportional to production levels. Table 6 shows the distribution of country elevators by region in comparison to the production of each

**Table 6: U.S. Country Grain Handling and Storage Facilities Compared to Production**

| Region | Facilities | % of Total | Off Farm Storage (MMT) | % of Total | On Farm Storage (MMT) | % of Total | Total Production (MMT) | % of Total |
|---|---|---|---|---|---|---|---|---|
| 2 – North East | 579 | 6.5% | 138.1 | 4.9% | 166.7 | 4.7% | 118.9 | 2.2% |
| 3 – Mid Atlantic | 307 | 3.4% | 38.1 | 1.4% | 51.4 | 1.4% | 162.3 | 3.0% |
| 4 – South East | 1,128 | 12.7% | 323.0 | 11.5% | 438.9 | 12.4% | 671.0 | 12.4% |
| 5 – North Central | 2,662 | 29.9% | 920.0 | 32.7% | 1,236.1 | 34.8% | 2,047.4 | 37.9% |
| 6 – South Central | 1,062 | 11.9% | 393.1 | 14.0% | 340.3 | 9.6% | 248.9 | 4.6% |
| 7 – Mid West | 1,973 | 22.2% | 714.9 | 25.4% | 811.1 | 22.9% | 1,219.0 | 22.6% |
| 8 – Northwestern | 592 | 6.7% | 146.7 | 5.2% | 334.7 | 9.4% | 667.7 | 12.4% |
| 9 – Pacific | 187 | 2.1% | 41.4 | 1.5% | 29.2 | 0.8% | 137.5 | 2.5% |
| 10 - PNW | 409 | 4.6% | 94.0 | 3.3% | 140.3 | 4.0% | 126.4 | 2.3% |

The companies operating the U.S. country network are diverse and represent a cross section that ranges from multinational exporters and food producers to farmer owned cooperatives. The top 10 companies operating in the U.S. country network represent 43.1% of the licensed storage capacity.[11] Those companies, the number of facilities operated and their associated storage capacity are shown in Table 7 below.

[11] As data for unlicensed facilities is available only by state from the USDA, it is not possible to examine the ownership of the entire network.

**Table 7: Top 10 Companies Operating Licensed Country Handling Facilities in U.S.**

| Rank | Company | Facilities | Storage Capacity (Tonnes) | Market Share |
|---|---|---|---|---|
| 1 | Cargill | 124 | 12,934,029 | 9.5% |
| 2 | Gavilon Grain | 116 | 7,733,800 | 5.7% |
| 3 | Archer Daniels Midland | 72 | 7,561,000 | 5.5% |
| 4 | CHS INC. | 234 | 7,555,686 | 5.5% |
| 5 | Bunge North America | 72 | 6,436,600 | 4.7% |
| 6 | Consolidated Grain & Barge Co. | 63 | 4,499,743 | 3.3% |
| 7 | Farmers Cooperative Co. | 59 | 3,453,800 | 2.5% |
| 8 | Riceland Foods Inc. | 31 | 3,262,857 | 2.4% |
| 9 | Attebury Grain | 38 | 3,054,029 | 2.2% |
| 10 | Perdue Grain & Oilseed | 46 | 2,480,400 | 1.8% |

# *Transportation and Logistics Infrastructure*

## The US Rail System

There are presently about 563 freight railways operating in the United States employing over 160,000 people and operating over 228,000 kilometers of rail line. Of these, 556 are classified as regional and shortline railways and account for less than 10% of total railway gross revenues generated by American carriers. More than 90% of freight revenue is generated by just seven carriers. Included in those seven are CN and CP, both of whom have extensive operations in the U.S.

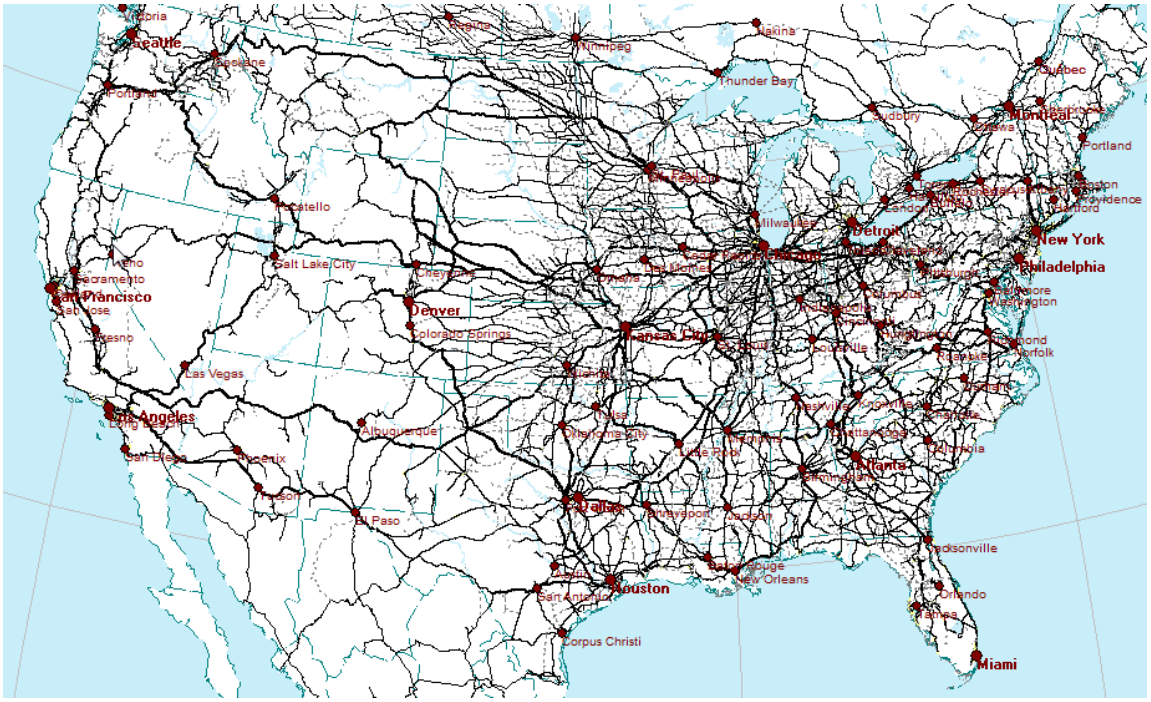



**Figure 8: U.S. Railway Network**

In Figure 8, the North American railway network is shown. The two largest U.S. carriers are Union Pacific Railroad and BNSF Railway, both which see approximately 20% of their revenues and workload associated with the movement of agricultural products. Both railways have the largest portion of their networks located in the central and western portions of the country and with a large proportion of grain either produced or routed west of the Ohio River, they have naturally become the largest rail service providers to the U.S. grain industry, with either or both railways having good access to all but a few of the major port terminals.

CN's network extends south from Winnipeg to Chicago and New Orleans, providing good access for both Canadian and US Mid Western grain to the Louisiana Gulf port facilities. CP's U.S. operations are slighly smaller and benefit from good access into the U.S. mid western states.

## The Eastern US Barge and River system

The United States Inland Waterways system operates over 25,000 miles of navigable waters, of which the Mississippi system, at 12,000 miles is the largest. (See Figure 9) The U.S. grain industry is just one of several bulk commodities that utilize this unique logistics alternative for moving product into both a domestic and export position. Of the grain products that move on the river, the largest proportion is destined for export through the Louisiana Gulf terminals.

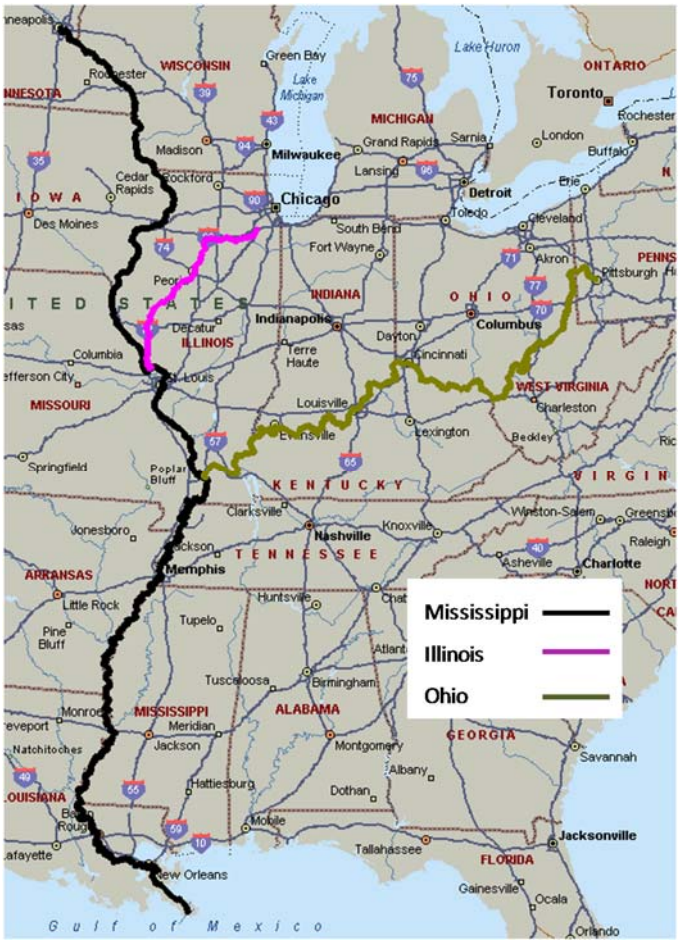



**Figure 9: Mississippi River System**

Grain is loaded on barges at one of 20 river based terminals on the Mississippi, Illinois or Ohio rivers and carried south as far as New Orleans where it is transferred to a terminal facility, or in some cases, loaded directly to an ocean vessel.

A barge will typically carry up to 1,500 tonnes of product. A single "tow" or movement will see up to 15 barges at one time lashed together and pulled by a single tug boat. The result sees over 22,000 tonnes of product move in one lot – the equivalent of over two trains.

This logistical approach is recognized as a highly competitive economic alternative to rail and as an environmentally responsible alternative given that fuel utilization for barges is typically 7-12% lower than for rail.

The Mississippi River system is viewed as a key strategic asset by the U.S. Government and as such is maintained by the U.S. Army Corp of Engineers. The system has 191 locks, several dams and weirs[12] and requires continuous dredging throughout to ensure that silt and debris normally carried through any river system is cleared and that adequate water depths are maintained for safe passage of the traffic that moves on the river. It is estimated that 13% of all U.S. export traffic uses the Mississippi River system to gain access to tidewater.

### Trucking of Grain in the US

The use of trucks in the movement of grain in the U.S. has become increasingly prevalent in recent years, particularly in the movement of goods to domestic markets. Similar to the Canadian experience, producers will use a mix of owned and contracted trucking services to position grain at both the country handling facilities as well as processors (milling, malt, feed etc.). Increased truck use has likely been influenced by the increased use of corn in ethanol production. Ethanol facilities will depend on a regular and metered supply of feedstock and the most effective logistical alternative is by truck from the farm gate.

# Disposition

As noted above and shown in Figure 10, 24% of US production moves to export markets as compared to Canada which exports 51% of its production. In the US, the largest export crop is corn, which on a three year average basis moves over 55MMT into the export marketplace (see Table 8). Wheat is their second largest export at 28 MMT. Canada's largest export of course is wheat and in the case of both countries, a large quantity of oilseeds is exported – soybeans in the case of the US and canola from Canada.

The US domestic market is dominated by corn in both the fuel (24%) and feed and industrial use (25%) as shown in Table 9. The US also sees 17% of its production

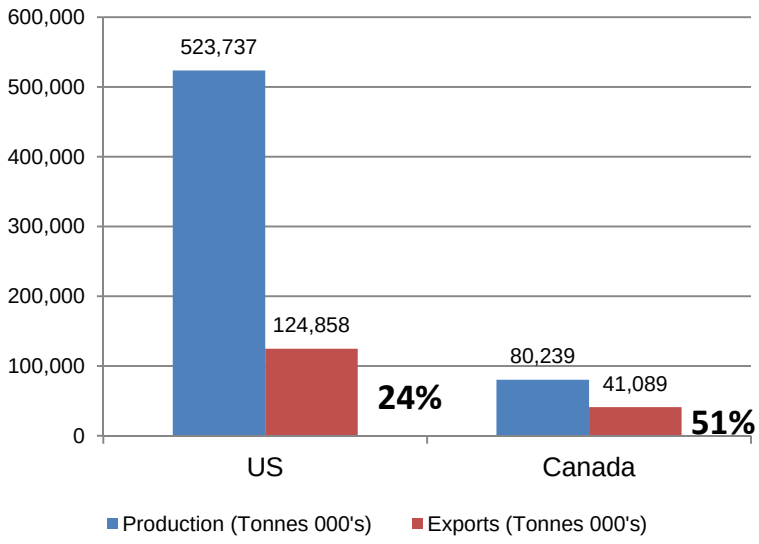



**Figure 10: U.S. vs. Canadian Grain Production (Major Grain crops – 3 year average to 2011)**

[12] A weir is a barrier across a river, typically smaller than a dam, designed to alter the flow characteristics.

move into the human consumption markets, reflective of the two countries' difference in population and demographics. (See Table 9)

| Commodity Group | Canada | United States |
|---|---|---|
| Corn | 998 | 55,521 |
| Wheat / Durum | 17,920 | 28,383 |
| Barley | 985 | 178 |
| Oilseeds | 10,151 | 39,000 |
| Pulses/ Special Crops | 4,458 | 1,258 |
| Processed and Other Grains | 6,577 | 518 |
| **Grand Total** | **41,089** | **124,858** |

**Table 8: Grain Exports: U.S. vs. Canada (3 year average 2009-11)**

| | | Canada | % of Total Prod | United States | % of Total Prod |
|---|---|---|---|---|---|
| Human Food | Barley | 0.0 | 0% | 3.1 | 1% |
| | Corn | 2.3 | 3% | 64.0 | 12% |
| | Other Grains | 0.1 | 0% | 1.1 | 0% |
| | Wheat & Durum | 2.8 | 3% | 24.8 | 5% |
| **Human Food Total** | | **5.2** | **6%** | **93.1** | **17%** |
| Industrial, Feed, Seed, Waste, Dockage | Barley | 7.4 | 9% | 1.1 | 0% |
| | Corn (for Fuel) | | 0% | 127.1 | 24% |
| | Corn (for Feed and Ind) | 14.0 | 17% | 137.2 | 25% |
| | Oilseeds | 6.5 | 8% | 50.9 | 9% |
| | Other Grains | 2.3 | 3% | 1.7 | 0% |
| | Wheat & Durum | 4.5 | 6% | 4.1 | 1% |
| **Feed, Waste, Dockage Total** | | **34.7** | **43%** | **322.1** | **60%** |

**Table 9: Total Domestic Disposition (3 year average 2009-11) (Source: United States Department of Agriculture Foreign Agricultural Service, Statistics Canada)**

# Transportation

Transportation of grain in the U.S. has seen substantial shifts in modal composition over the last 35 years in response to the changing demands of the commodities produced and the markets it serves. Most notable has been the increase in the use of trucking. (See Figure 11) In 1984 trucks moved less than 34% of the total crop but by 2010 that had increased to over 58%, representing almost 300 MMT annually. While absolute tonnages by barge have remained relatively steady at approximately 65 MMT annually, rail has increased from 124 MMT to over 150 MMT.

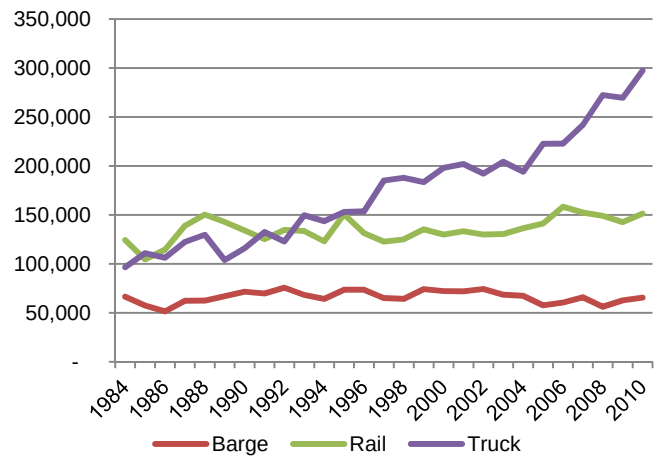



**Figure 11: U.S. Grain Movement by Transportation Mode (Source: USDA Agricultural Marketing Service modal share study 2010)**

In comparing the domestic and export movements by mode and commodity, it was found that trucking is the dominant mode of transport for domestic movements handling more than 73% of total movements on average for the last five years. Rail moved just over 25% and barge just over 1%.

Figure 12 clearly shows the dominance of corn movements by truck. This commodity has been the driver of growth in truck activity during the last 35 years.

The modal division in positioning grain to an export position is considerably different than that seen in the domestic markets, with rail and barge being the dominant transportation modes accounting for 48% and 42% of total movements respectively. Corn, at 31 MMT per year, is the largest commodity moved by barge representing 53% of total barge movements.

An average of 64 MMT moves by rail with corn and wheat evenly split at 22 MMT each. Soybeans make up the majority of the remaining rail movement at 16 MMT annually.

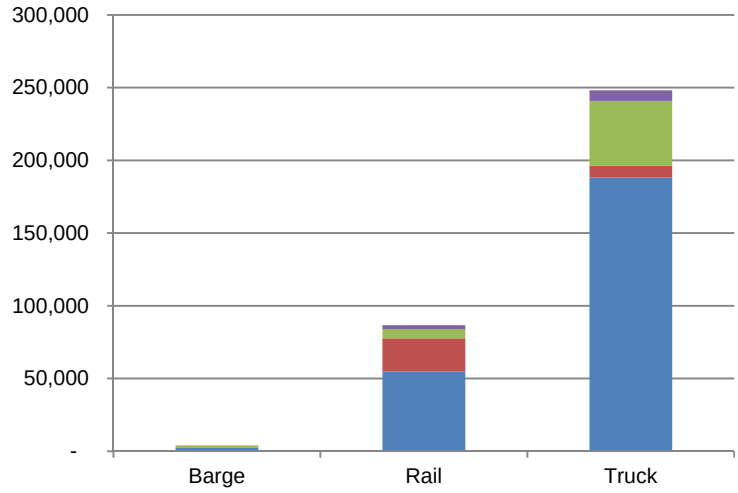



**Figure 12: Five Year Average Domestic Tonnage by Mode**

Truck movement represents only 10% of movements to export position largely because of the length of haul, which makes the rail and barge modes more economically efficient and therefore preferential to shippers. (See Figure 13) Moreover, port facilities are most often designed with large lot bulk handling in mind. Truck movement will be confined to short haul (less than 500 kilometers).

In the western regions, the railways' shift to an increased use of unit trains has had an impact on overall costs and made rail a more popular option for shippers. This has resulted in a shift of 5½% in modal share from barge to rail over the last 30 years.

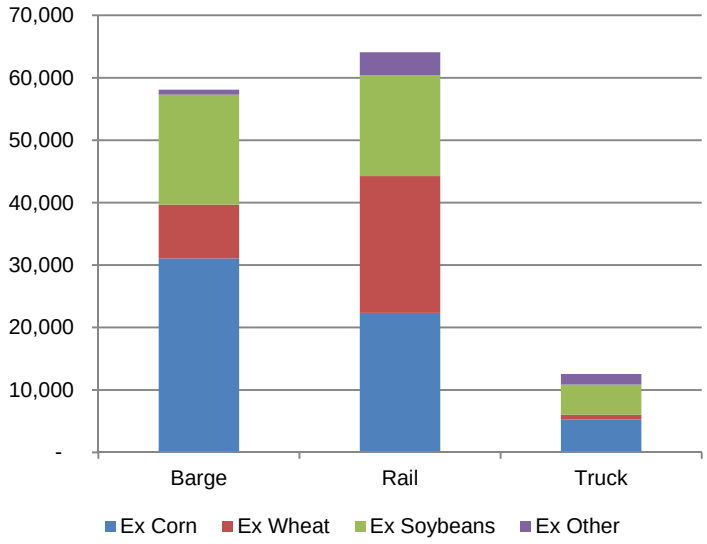



**Figure 13: Five Year Average Export Tonnage by Mode**

Railway strategies with respect to railcar allocation have had minimal impact on the choices grain shippers make in terms of the markets they target. Despite the railways' continued seasonal freight pricing strategies whereby railways may charge higher freight rates during peak shipping periods, grain companies are quick to point out that these freight differentials pale by comparison to the incremental margins they can earn by moving grain into certain global markets during peak pricing seasons, such as the post harvest and late spring timeframes.

Railway bid car programs are used by grain shippers to reserve car supply particularly through peak periods when pricing opportunities are greatest. While these programs do incent some degree of demand peak smoothing through the year, railways who have bid car programs in place such as BNSF and Union Pacific point to the fact that bid car contracts do offer grain companies flexibility in that they can be traded among shippers. Many grain shippers will enter into a bid car program and contract for a full year, with the intent of selling a portion of their capacity to other shippers. An example of this would be a situation where a company looking to move corn or wheat to PNW port terminals from October to April partners with company looking to move corn into south east ethanol markets or Louisiana Gulf ports from May until September.

Much like shippers in Canada, US rail shippers have recently been lobbying the US Federal Government for increased shipper protection legislation. Perhaps in response to these shipper initiatives the BNSF has recently changed its approach to adminstrative and operating penalties by implementing reciprocal penalties for service failures. In doing so they have put in place systems and processes that track and pay penalties when they fail to deliver to the standard they have agreed to with the shipper. Other US railways have also begun to look at similar practices in light of recent discussions by legislators with respect to strengthening shipper protection laws and regulations in the US.

# Markets

The U.S. grain market should be viewed in terms of corn and then everything else. Driven in part by legislative actions tied to fuel initiatives and subsidies, corn prodcution in the U.S. is the foundation of the industry and is therefore the base of the supply chain. The volumes involved go a long way to supporting the logistics infrastructure and therefore the cost structure of the grain supply chain. In Canada that was the case with wheat, however in the past 15 to 20 years the system has become less dependent on a single commodity through diversification. This is happening in the U.S. in some regions, particularly in the North West and Pacific Northwest where wheat (including durum) and special crops are becoming more predominant.

The second most important factor with the U.S. grain market is the broad involvement of multi-national companies who trade in global markets. As over half of port facilities are controlled by multi-nationals (50.5%) and well over a third of the country elevator space (38.3%), their interests and the global markets they trade in have an influence on what they are most interested in buying from the U.S. producer. While this will have a limited impact on how the domestic markets operate, it does have an impact on how export trading is handled - in particular how and with which countries and buyers the companies trade.

The U.S. grain markets trade based on price signals that come from the three major grain trading floors: The Chicago Board of Trade (CBOT), The Minneapolis Grain Exchange (MGEX) and the Kansas City Grain Exchange (KCBT). This includes current and futures markets trades as all three trade in both.

## *The Stakeholders, their roles and relationships*

Domestic buyers of U.S. grain are first the ethanol producers, and next the feed markets, the two of which account for over 60% of U.S. production. As noted above, human consumption represents 17% of the total U.S. production. The following discusses each of the stakeholder groups, what they buy and sell in the U.S. grain supply chain, and how this differs from the Canadian market.

### Producers

Predominantly family farm owners but increasingly, corporate farms with directed production

*What they buy and from whom:* Seed, other crop inputs from both corporate agro science dealers as well as local seed dealers. Often, local farmer owned cooperatives will “bulk buy” crop inputs.

*What they sell and to whom:* All crop production in the US emanates from farm based production. As noted above, an increase in corporate farming has been seen although no reliable tracking of the total marketplace is available. Companies involved in either ethanol or livestock production, such as Tyson Foods, are increasing their interests in grain production to secure feedstock for their main production.

The means by which their grain is sold varies dependent on the crop and the buyer. Cereal crops are sold to either a grain company or directly to a miller, a maltster (in the case of malt barley) or a feed mill. The nature of the commercial relationship between all is similar. Grain is sold either through a forward contract or on a direct sale, the latter of which is declining in use with most buyers and producers favouring the establishment of longer term agreements so as to mitigate risk on both sides.

Corn and special crops are sold in much the same manner with ethanol producers looking for stable supplies of starch based feedstock and feed mills sourcing the lowest cost form of protein. Ethanol producers will look to establish forward contracts wherever possible, while feed mills will look to source on a cash basis

*How this differs from the Canadian market:* The use of forward contracts on non cereal grains has been used in canola and some pulse crops over the past number of years. The Canadian Wheat Board introduced a modified form of a forward contract in recent years, but most cereal grains were sold through the pooling options. There were some modified exceptions to this such as Warburton's Bakery for which wheat production is contracted. The current crop year saw offerings of forward contracts; however this option is still being developed between grain companies and producers in Canada.

## Agribusiness Crop Suppliers

Companies such as: Monsanto, Dow AgroScience, Bayer, BASF, Dupont, Syngenta who are involved in the development of hybrid seeds and associated chemical inputs for improved quality and yield

*What they buy and from whom:* Agribusiness companies will contract for the production of the seed of hybrid or modified grains which they hold patents on.

*What they sell and to whom:* They sell this grain to producers either directly or through dealers and farmer cooperatives. The terms of sale are normally cash or a modified form of credit through dealers or cooperatives.

*How this differs from the Canadian market:* There is little difference in the relationships between corporate agribusiness and producers in the U.S. and Canada, however, the current variety registration regulations in Canada place restrictions on the types of grain that can be produced to those that have been through the approval process.

## Ethanol producers

There are presently 92 ethanol operating production facilities in the U.S. owned by 79 separate companies[13]. There are 82 of those facilities that use corn as their primary feedstock. The largest of the companies is Archer Daniels Midland who operates 7 plants with production capabilities of over 1 billion gallons annually.

[13] Source: Renewable Fuels Association Bio-refinery locations - 2012

*What they buy and from whom:* Feedstock from producers. As noted above, corn is the largest form of starch used in ethanol production (93% of capacity) but other grains used include wheat, barley and sorghum, although these account for less than 6% of the total feedstock supplied.

*What they sell and to whom:* Ethanol to gasoline producers (oil companies) to meet US regulatory blending standards as well as dried distilled grains for use in the feed markets. As noted above, most ethanol production facilities will establish forward contracts with producers to ensure a steady supply of feedstock and with the intent of finding some form of price (cost) stabilization.

*How this differs from the Canadian market:* Blending of ethanol into gasoline remains voluntary for Canadian oil companies and as such the demand for ethanol has not seen the increases experienced in the US, nor has the grain market been impacted except where demand for corn has caused an increase in the price of livestoock feed grains.

## Feed Industry

The feed industry in the U.S. supplies the livestock feed requirements for meat production. The science of livestock feed has advanced rapidly and as such, driven by an increase in consumer awareness, as well as regulatory changes driven by events such as BSE, market demand has changed from one of "protein at the lowest cost" to the current situation that includes the feed's contents, quality and genetic attributes as well as cost. Increasingly, food manufacturers involved in high output livestock operations such as Tyson Foods have entered into grain production as a way of ensuring supply of product.

*What they buy and from whom:* Feed processors source directly from producers, but increasingly look to the dry distilled grains (DDG) markets from ethanol production and oil seed crush from soybean and canola operations. Some grain sourced from producers and most DDG's will be purchased on a contract basis.

*What they sell and to whom:* Livestock mills sell to feed lots, poultry and dairy producers and finishing barns as well as food manufacturers.

*How this differs from the Canadian market:* This is no different from the Canadian market, in fact, the U.S. feed market is a consumer of many Canadian products such as canola pellets from crushing operations as well as Canadian oats, barley and feed wheat

## Millers and food manufacturers

Millers and food manufacturers will source most of their product on a forward contract basis, much of it directly from the producer with the larger portion from smaller grain companies and cooperatives where quality and consistency can be tightly managed.

The kinds of companies involved can range from small millers to large multinational food manufacturers such as General Mills. Companies will have established agents through the growing areas who contract with

producers as far out as two years. Many of these agreements are based on long term relationships. Many of the companies also construct and manage country receiving and handling facilities.

*What they buy and from whom:* All grains under contract from producers and from local cooperatives and dealers. Most commercial arrangements are on a forward contract basis tied to prices based on one of the three futures markets. As noted above, the buyer looks to establish tight controls on quality and consistency, with price adjustments in the contract tied closely to the management of that consistency.

*What they sell and to whom:* The products these companies produce cover the range from basic foodstuffs (breakfast cereals to soups, bread, beer and spirits) to sophisticated derivative products that use grains as a feedstock (i.e. corn sugar syrup, lysine, etc.)

*How this differs from the Canadian market:* The demographic differences between the U.S. and Canada dictates that Canada's internal demand from human consumption products is significantly lower. However, the US is a consumer of Canadian products, such as milling wheats and oats.

## Grain Cooperatives

The country gathering network in the US has hundreds of farmer owned grain cooperatives that own and operate receiving, storage and loading facilities. In some cases these cooperatives will act as a dealer and others as agents for dealers and exporters. While the data to determine what proportion of the country handlings flow through these types of facilities, their continued existence, as well as their increase in numbers over the past years would suggest that they have flourished. The size of these facilities can vary from 2,000 tonnes capacity up to 150,000 tonnes. In discussion with US producers, it was suggested that these cooperatives were formed in answer to a void in the market as well as a belief that the cooperative would give farmers a better option in which to both market their product as well as purchase inputs using a volume economics approach.

*What they buy and from whom:* Handle all types of grains

*What they sell and to whom:* As noted above.

*How this differs from the Canadian market:* While the cooperative grain company system in Canada was what ultimately formed the base of Viterra, now owned by Glencore, a new cooperative system is in the works in the form of producer owned inland terminals such as representated by the Inland Terminal Association. More recently we have seen a number of producer owned shortlines established through the railway abandonment process and trackside producer car loading sites constructed. This would suggest that the same economic drivers influence producers on both sides of the border.

## Grain Companies

The US grain market is served by a broad cross section of grain companies of both a local, national and multinational base. Multinationals include Cargill, ADM, Scoular, Louis Dreyfus amongst others whose

interests lie in both the domestic and global export markets. Nationally companies such as Columbia, The Andersons and Gavilon have established themselves in both markets.

*What they buy and from whom:* Grain companies in the US operate in a manner not unlike Canada in that they buy grain from producers for sale in both the domestic and export markets. For many producers this relationship is preferred as it simplifies their choices and to some degree mitigates the risk. The grain company is often the retailer of crop inputs with many of them operating in both a retail and wholesale fashion.

The licensing of grain facilities as locations for the acceptance and administration of grain being sold under the US loan management programs provides some marketing advantage to these companies and most operate under those licenses.

The commercial relationship between the producer and the grain company is either on a forward contract basis or cash purchase on the driveway. While the proportion of contract to cash will vary from producer to producer and company to company, the ranges go from 20-70%, dependent on each entity's desire to manage or accept risk and the way the markets are showing at any particular moment.

The producer contract approach most popular in the US grain markets today and used by both grain companies and millers is the "hedge to arrival" contracts. In these contracts a producer will establish a contract price for a specific month in the future, ostensibly a period for the next crop (i.e. September of the following year). The contract price will be set on a particular grain exchanges futures price for that month. Typically a contract will stipulate a number of lots (typically a lot size is 5,000 bushels) and the terms of delivery (the location of the delivery facility and the month of delivery, the grade and protein expectation etc.). Risk is mitigated by the buyer through an agreement that states that grade and protein differentials will be adjusted at the time of delivery. The producer must then deliver the product at that forward point in time and accepts the adjustments as determined by the buyer at the time of delivery.

*What they sell and to whom:* As noted above, dependent on the product and the company, grain companies in the US will be involved in both the domestic and export markets. The multinationals that are also involved in the manufacturing of food (Cargill and ADM for example) use the country network to source for all of their operations, whereas companies such as The Andersons and Gavilon will work with both dealers and other international exporters in the sourcing and gathering of product for positioning of an export sale.

The nature of the export sale will vary dependent on the buyer, although it has been suggested by many that where FOB terms were once a prevalent approach, buyers are opting to move to C&F/ CIF terms as they wish to control the terms of the ocean freight, likely looking to take as much advantage of low ocean freight costs that are in place presently.

*How this differs from the Canadian market:* There are few differences in how this portion of the US market works as compared to Canada with the exception of the management of the commercial transaction. In most cases the transaction in and of itself (i.e forward contracting) is used more often as it has been a practice in place for a longer period of time. The producers in the US interviewed for this assessment believe that as

the recent Canadian market changes become more established, these more sophisticated contracting approaches will become the norm as well.

# Summary of the Canadian – US supply chains

It is the view of many industry stakeholders that the North American grain industry is evolving into a continental market, the Canadian Wheat Board marketing change being just one in a series of events driving the transformation. The industries in the two countries have competed in only a few areas over the past 20 years – most predominantly in global wheat sales, yet even that was limited as there are many differences in the quality and intended use of the varying wheat types. In real terms, the types of grain crops that are grown are as much a function of climate and geography as they are about the markets they are intended for. Canadian prairie geography and climate is geared to a type of grain with attributes that are different than a grain grown in Iowa or Kansas. This contributes to why many US millers look to buy a portion of their milling wheat from Canada so as to allow them to blend to a certain specification. In many ways the two markets complement one another. This is a leading rationale of those who believe the evolution will be to a North American one.

How the pricing of Canadian grain will evolve remains in question as the ICE[14] futures market continues to look for increases in its use and therefore relevance in its new markets (barley, durum and wheat). Many have begun to use the US grain exchanges as the basis in which they trade and one (MGEX) is now pricing futures on Canadian grain and accepting Canadian grain to settle futures contracts. It too lends to the continental market theory.

Production contracts have evolved considerably over the past 12 months when the first cereal grain contract was offered by a grain company in Canada. Since the transition from a single desk for marketing of wheat, durum and barley to an open market, it is likely that as the markets mature and grain companies' understanding of both markets becomes better, we will see an increase in the amount of producer contracts and better forward planning of sales and logistics. It is the opinion of most that increases in forward contracting will lead to the greater stregthening of relationships between buyers and producers in the future.

[14] ICE refers to ICE Futures Canada which is the Canadian arm of Intercontinental Exchange, traded on the NYSE. It was formed from the former Winnipeg Commodity Exchange